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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Complete if Known	
Application Number	10/612,125
Filing Date	July 2, 2003
First Named Inventor	Kueny
Art Unit	2612
Examiner Name	Misleh, Justin P.
Attorney Docket Number	946959600013

Total Number of Pages In This Submission: 58

ENCLOSURES (check all that apply)

- ☐ Fee Transmittal Form
  - ☒ Fee Attached
- ☐ Amendment / Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Response to Missing Parts/Incomplete Application
  - ☐ Response to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Assignment Papers *(for an Application)*
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
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- ☐ Appeal Communication to Board of Appeals and Interferences
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- ☐ Proprietary Information
- ☐ Status Inquiry
- ☒ Return Receipt Postcard
- ☒ Other Enclosure(s) *(please identify below)*:

Letter regarding Appeal Brief

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	Rudolph J. Buchel Jr. (Reg. No. 43,448) ***Rudolph J. Buchel, Jr., P.C.*** P.O. Box 702526 Dallas, Texas 75370-2526
Signature	Rudolph J. Buchel
Date	June 27, 2007

CERTIFICATION OF TRANSMISSION

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Typed or printed name	Rudolph J. Buchel Jr.		
Signature	Rudolph J. Buchel	Date	June 27, 2007

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	**10/612,125**
Applicant	:	**Kueny**
Filed	:	**July 2, 2003**
TC/AU	:	**2612**
Examiner	:	**Misleh, Justin P.**
Docket Number	:	**946959600013**
Customer No.	:	**41498**
Re	:	**Apparatus and Method for Enhancing Dynamic Range of Charge Coupled Device-Based Spectrograph**

MS Appeal
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

LETTER REGARDING MAILING OF APPEAL BRIEF

Sir:

In furtherance of a Notice of Appeal Parts mailed on December 28, 2006, an appeal brief was mailed on February 14, 2007 with a certification. The Examiner in charge of the case indicated on June 26, 2007 that the brief has not been received. Therefore, a copy of the appeal brief is enclosed as it was mailed in February.

No fees other that those for the filing of an appeal brief are believed to be necessary at this time. No extension of time is believed necessary. If, however, an extension of time is needed, the extension is requested. Please charge the fees for an extension of time to account number ***50-3328*** in the account name of ***Rudolph J. Buchel, Jr., PC***.

Respectfully submitted,

DATE: June 27, 2007

Attorney for Applicant

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CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.8(A)

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on *June 27, 2007* by ______________ Rudolph J. Buchel, Jr.

PTO/SB/21 (02-04)
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Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	Rudolph J. Buchel Jr. (Reg. No. 43,448) ***Rudolph J. Buchel, Jr., P.C.*** P.O. Box 702526 Dallas, Texas 75370-2526
Signature	[signature]
Date	February 14, 2007

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Typed or printed name	Rudolph J. Buchel Jr.		
Signature	[signature]	Date	February 14, 2007

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	**10/612,125**
Applicant	:	**Kueny**
Filed	:	**July 2, 2003**
TC/AU	:	**2612**
Examiner	:	**Misleh, Justin P.**
Docket Number	:	**946959600013**
Customer No.	:	**41498**
Re	:	**Apparatus and Method for Enhancing Dynamic Range of Charge Coupled Device-Based Spectrograph**

ATTENTION: Board of Patent Appeals and Interferences

APPELLANT'S BRIEF ((37 C.F.R. 41.37(C)(1)

This brief is in furtherance of the Notice of Appeal, filed in this case on **December 28, 2006.**

The fees required under §1.17(c), and any required petition for extension of time for filing this brief and fees therefore, are dealt with in the accompanying TRANSMITTAL OF APPEAL BRIEF.

CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.8(A)

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on *February 14, 2007* by ______________________

Rudolph J. Buchel, Jr.

This brief contains these items under the following headings, and in the order set forth below (37 C.F.R. 41.37(c)(1)):

I. REAL PARTIES IN INTEREST (37 C.F.R. 41.37(c)(1)(i)):

The real party in interest in this appeal is the following party:

Verity Instruments, Inc.
2901 Eisenhower Street
Carrollton, Texas 75007

II. RELATED APPEALS AND INTERFERENCES (37 C.F.R. 41.37(c)(1)(ii)):

With respect to other appeals or interference's that will directly affect, or be directly affected by, or have a bearing on the Board's decision in the pending appeal, there are no such appeals or interference's.

III. STATUS OF CLAIMS (37 C.F.R. 41.37(c)(1)(iii)):

A. TOTAL NUMBER OF CLAIMS IN APPLICATION

Claims in the application are: 50

B. STATUS OF ALL THE CLAIMS IN APPLICATION

1. Claims canceled: None

2. Claims withdrawn from consideration but not canceled: None

3. Claims pending: 1 - 50

4. Claims allowed: 5 – 13, 17 – 22 and 30 – 32 have been objected to and would be allowed if rewritten to include the limitation of the intervening claims.

5. Claims rejected: 1 – 4, 14 – 16, 23 – 29 and 33 – 50

C. CLAIMS ON APPEAL

The claims on appeal are: 1 – 4, 14 – 16, 23 – 29 and 33 – 50

IV. STATUS OF AMENDMENTS (37 C.F.R. 41.37(c)(1)(iv)):

No amendments have been submitted in any After Final Response to Office Action that have not been entered.

V. SUMMARY OF CLAIMED SUBJECT MATTER (37 C.F.R. 41.37(c)(1)(v)):

One aspect of the present invention is directed to a method, device and software program product for enhancing dynamic range of a prior art charge-coupled device (CCD) by reading out the CCD using a novel *two-region line binning mode.* A prior art CCD (similar to imaging array **200** shown in **FIG. 3**), or the like, that is typically employed in spectroscopy applications is configured as an arrangement of N x M cells or pixels that are organized in N linear pixel arrays of charge-coupled pixels (vertical columns), wherein each vertical column has M pixels. Hence, array **200** has N linear pixel arrays (vertical pixel columns) of charge-coupled pixels and M rows of pixels. The last pixel in each of the N linear pixel arrays is coupled to a single register in horizontal serial shift register **206** (one of registers **206-1** through **206-N**). In an imaging spectrograph, a spectrum is projected with the spectra wavelengths corresponding to the N linear pixel arrays (vertical columns) in array **200** (the spectral lines are shown in the figure as dark vertical bands).

According to the prior art, the charge integrated in the CCD from exposure to the spectral light is read out in a "*line binning mode.*" In line binning mode, the charge integrated in any one of the N linear pixel arrays is combined separately in each of the N shift registers. Because the pixels in each of the N linear arrays are charge-coupled, the charge is shifted vertically down a linear pixel array, in unison, and combined in the serial shift register for that array. Essentially, the M pixels lines (rows) of array **200** are treated as a single *dependently controlled* region that is shifted line by line down array **200**, in unison, and combined in the N shift serial registers. Once the charge is combined in the N serial shift registers, it is horizontally shifted out of horizontal serial shift register **206** and off of the array **200**, where the charge can be converted to data signals representative of the respective spectral intensities projected on the corresponding linear pixel arrays.

The amount of charge that accumulates in a linear pixel array is proportional to both the light intensity at the wavelength which illuminates that array and the integration

time that charge is allowed to accumulate before it is read. In prior art spectrographs, the integration time is chosen so that the quantity of charge in each column lies within a useful dynamic range of the CCD. A problem occurs if the spectrum of interest includes wavelengths of widely differing intensities, since there may be no single integration time which is suitable for the entire spectrum. If the integration time is too long, the amount of charge accumulated for the brightest spectral lines may saturate the pixel wells and/or the corresponding shift register resulting in a clipped intensity value for those spectral lines. Alternatively, if the integration time is shortened to prevent the intensity of bright spectral lines from being clipped, then the amount of charge accumulated for the dimmest spectral lines may be statically lower than the inherent noise of the CCD resulting in a poor signal-to-noise ratio, hence the intensity reading dim spectral lines may be indistinguishable from the background noise of the CCD.

Claims **1 – 32** are directed to a *two-region line binning mode* for enhancing dynamic range of data obtained from a prior art charge-coupled device (CCD), without modifying the prior art CCD in any way. In using the present invention it is possible to obtain accurate intensity data from a spectrum that includes wavelengths of widely differing intensities. This embodiment is represented diagramically on **FIG. 5** and the two-region line binning mode is shown in the flowchart depicted on **FIG. 6** which is described beginning on page 12, *et seq.* Essentially, a CCD array is divided into two separate pixel regions and charge integrated in the pixels cells of the regions. The charge integrated in the first region is combined in serial shift registers that are coupled to the CCD array, and horizontally shifted off the array, and then the charge integrated in the second region is combined in the serial shift registers and horizontally shifted off the CCD array. By allocating a different number of pixel rows to the first dependently controlled region than the second dependently controlled region, the *two-region line binning mode* enhances dynamic range of data obtained from the CCD array.

More particularly, the M pixel lines (rows) of array **200** are treated as *two* separate regions for reading out charge in the CCD array, rather than reading out

charge as a single region as is done in the prior art line binning method. However, because the present invention may be implemented in a prior art CCD, these two pixel regions are dependently controlled, hence, the charge integrated in one region cannot be shifted without also shifting the charge from the other region, *i.e.*, the charge shifts down the parallel linear pixel arrays cells of array **200** in unison. In accordance with one exemplary embodiment of the present invention, the M pixel lines of array **200** are allocated to one of a first region, region *a* having *a* pixel lines, and a second region, region *b* having *b* pixel lines. Thus, each of the N linear pixel arrays has *a* number of pixels in region *a* and also has *b* number of pixels in region *b,* wherein $M = a + b$ and typically $b >> a$. Next, the charge integrated in array **200** is read out using the present *two-region line binning mode*. First, the charge integrated in region *a*, the closest to the serial shift registers, is shifted down array **200**, pixel line by pixel line, and combined into the N shift registers of horizontal serial shift register **206**. Because regions *a* and *b* are dependently controlled, *i.e.*, the charge from one region cannot be shifted without also shifting the charge from the other region, the charge from both regions is shifted vertically downward on array **200**, in unison, as the charge that was originally integrated in region *a* is combined in horizontal serial shift register **206**. Therefore, when the charge from the *a* pixels lines for region *a* has been combined in horizontal serial shift register **206**, the charge from region *b* then occupies the next *b* pixel lines above horizontal serial shift register **206** (or at least *a* pixel lines closest to the shift registers). The charge from region *a* is then horizontally shifted out of horizontal serial shift register **206** and off of the array **200** and converted to an amplitude channel. As there are far fewer pixels allocated to the region *a* portion of the linear pixel arrays than the region *b* portion of the linear pixel arrays, the amount of charge combined in the shift registers can be reduced below the saturation level for the bright spectral lines, thus a large-amplitude channel is produced from this region representative of brighter spectra. Hence, the intensities of very bright spectral lines can be measured from region *a* without clipping the intensity levels at the saturation values.

Next, the charge integrated in region *b* is read out of array **200** by combining the charge from the *b* pixel lines closest to the horizontal shift register in the N shift registers. The charge from region *b* is then horizontally shifted out of horizontal serial shift register **206** and off of the array **200** and converted to a second, but smaller amplitude channel, exactly as was described above for the region *a* portion of the linear pixel arrays. However, since the region *b* portion of the linear pixel arrays has many more pixels than the region *a* portion of the linear pixel arrays, the amount of charge combined in the shift registers can be increased to a signal-to-noise ratio adequate for distinguishing the intensities of very dim spectral lines above the background noise of the CCD. Hence, the intensities of very dim spectral lines can be measured from region *b* without interference from background noise. Moreover, the number or rows in regions *a* and *b* may be predicated on a desired improvement to the dynamic range of the prior art CCD (see page 13, line 10 *et seq.* and Equation (1)) or other events (see page 22, line 4, *et seq.*). Consequently, the present *two-region line binning mode* enhances the dynamic range of data obtained from a prior art charge-coupled device (CCD) without modifying the prior art CCD in any way.

It may be appreciated that array **200** may be continually exposed to the spectral light during readout. Consequently, as the charge from regions *a* and *b* is horizontally shifted out of horizontal serial shift register **206**, unwanted charge is integrating in the pixel cells of array **200**. Therefore, in the next measurement cycle the unwanted charge from array **200** may be combined in horizontal serial shift register **206**, the integration time restarted and the unwanted charge is horizontally shifted out of horizontal serial shift register **206**. Thus, unlike the cited prior art, the present invention does not require the use of an elaborate shutter system to isolate the array during readout.

Claims **33 – 50** are directed to a method for reading out a prior art CCD imaging sensor in which multiple spectrums have been simultaneously projected without obliterating one spectrum with spectral light from the other, and without the need for modifying the prior art CCD. This embodiment is represent diagramically on **FIG. 12**,

which is described beginning on page 24 *et seq.* and a variation of the two-region line binning mode applicable to imaging spectrographs in which two or more images are projected is shown in the flowchart depicted on **FIG. 13**. It is difficult to accurately measure the intensities of two spectrums that are simultaneously projected on a CCD array due to the deficiencies of the prior art line binning mode. As charge from the first spectrum is shifted to the shift registers, the charge from the second spectrum is shifted to the spectral light from the first spectrum. As the charge from the first spectrum is read out of the shift registers and off the CCD array, the charge from the second spectrum is obliterated by the spectral light from the first spectrum, thus rendering the data worthless. The prior art solves this problem by first projecting one spectrum on the CCD, reading that spectrum out using the line binning mode, and then projected a second spectrum on the same CCD and reading out the second spectrum. While the prior art solution does not necessitate modifying the CCD array itself, it does induce a lag time between measurements of the two spectrums resulting in an unwanted error.

The lag time and unwanted error is overcome by using the present invention for separately reading out the charges from the two spectrums that are simultaneously projected on a CCD array. Essentially, a prior art CCD array **1202** is divided into three separate regions, two regions for receiving separate light spectrums and a third dark region that is isolated from light. See page 23, line 7, *et seq.* The dark region should be as large as the first two regions combined and is situated between the horizontal serial shift register and the other two regions. In operation, separate light spectrums are projected on each of the first two regions for an integration time and then the charge integrated in the regions is shifted out of the two regions, down the linear pixel arrays of CCD array **1202**, and into the dark region. In the dark region, the charges from the two spectrum remain isolated from one another and are protected from any light contamination. They may then be read out using, for example, the two-region line binning mode described above. See page 25, line 7, *et seq.*

More particularly, the 2M pixel rows of array **1202** are treated as *three* separate regions for reading out a prior art CCD array, rather than as a single region that is sequentially read out with different spectrums as is typical using the prior art line binning mode. As the present invention may be implemented on a prior art CCD, the three regions are dependently controlled, hence, the charge integrated in the pixel cells of the regions cannot be shifted independently, *i.e.*, the charge will always shift down the linear pixel array in unison. The 2M pixel lines of array **1202** are allocated to one of the first region, region *a* having *a* pixel lines, and the second region, region *c* having *c* pixel lines and a third region that has M pixel lines, the dark region. The dark region is large enough to accommodate all of the charge integrated in regions *a* and *c*, and has M pixels rows, where $M \approx a + c$ and typically $c \approx a$. Regions *a* and *c* are large enough such that spectrums **1102** and **1104** can be projected within the respective regions without the spectral light contaminating the opposite region (hence, one or more rows along the border between regions *a* and *c* may not receive any spectral light).

Initially, spectrum **1102** is projected on region *a* and spectrum **1104** is simultaneously projected on region *c* for an integration time, after which the charges integrated in regions *a* and *c* is shifted down array **1202**, line by line, into the dark region and isolated from the spectral light. Because regions *a, c* and the dark region are dependently controlled, *i.e.*, the charge from one region cannot be shifted without shifting the charge from the other, so the charges will shift vertically downward on array **1202** in unison. Once in the dark region, the charge integrated from exposure to spectrums **1102** and **1104** is isolated from any light contamination while awaiting readout. As a practical matter, as the charges from regions *a* and *c* are shifted into the dark region, unwanted charge from the dark region is simultaneously shifted into the horizontal serial shift register **206**. Therefore, the unwanted charge can be horizontally shifted out of horizontal serial shift register **206** (not saved) while the charges from regions *a* and *c* occupies the dark region of array **1202**.

At this point, the two-region line binning mode may be used to read out the charge in the dark region as described immediately above. Initially, the charge from the region closest to horizontal serial shift register **206**, region *a*, is combined in the N serial shift registers of horizontal serial shift register **206**. After which, the charge from region *c* occupies the next *c* pixel lines above horizontal serial shift register **206**. The charge from region *a* is then horizontally shifted out of horizontal serial shift register **206**, off of the array **1202** and converted to a first amplitude channel. Next, the charge integrated in region *c* is read out of array **1202** by combining the charge from the *c* pixel lines closest to the horizontal shift register in the N shift registers of horizontal serial shift register **206**. The charge from region *c* is then horizontally shifted out of horizontal serial shift register **206** and converted to a second amplitude channel. Finally, an unwanted charge is integrated in array **1202** while regions *a* and *c* are read out. That unwanted charge is combined in horizontal serial shift register **206** and discarded. The process can then be reiterated by restarting the integration time period and integrating another charge from spectral light projected on regions *a* and *c*.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL (37 C.F.R. 41.37(c)(1)(vi)):

The issues on appeal are whether:

Claims **1 - 4, 14 - 16, 23 - 29** and **33 - 50** are unpatentable over West (U.S. Patent No. 5,986,267) under 35 U.S.C. § 102(b).

VII. ARGUMENTS (37 C.F.R. 41.37(c)(1)(vii)):

A. The rejection of claims **1 - 4, 14 - 16** and **23 - 29** under U.S.C. § 102(b) is incorrect.

I. With respect to claims **1 - 4, 14 - 16** and **23 - 29,** nowhere does the prior art cited by the Examiner describe a method for "combining charge from a first dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge from the first dependently controlled region along each of the N linear pixel arrays to each of the N registers..." in combination with "combining charge from a second dependently controlled region of the N linear pixel arrays in the N registers by shifting charge from the second dependently controlled region along each of the N linear pixel arrays to each of the N registers, <u>said first and second dependently controlled regions having at least three pixel lines</u> ..."

Appellant respectfully asserts that prior art reference anticipates the claimed invention under 35 U.S.C. § 102 only if every element of a claimed invention is identically shown in that single reference, arranged as they are in the claims. *In re Bond*, 910 F.2d 831, 832, 15 U.S.P.Q.2d 1566, 1567 (Fed. Cir. 1990). All limitations of the claimed invention must be considered when determining patentability. *In re Lowry*, 32 F.3d 1579, 1582, 32 U.S.P.Q.2d 1031, 1034 (Fed. Cir. 1994). Anticipation focuses on whether a claim reads on the product or process a prior art reference discloses, not on what the reference broadly teaches. *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 218 U.S.P.Q. 781 (Fed. Cir. 1983).

Nowhere does West teach or suggest combining any charge whatsoever in a shift register (*e.g.*, horizontal registers **304** or **305**) as expressly recited and required by claims **1, 25** and **28**. West teaches only to enter charge from a single pixel row into a horizontal register and not to combine charges in the horizontal register. More particularly, West teaches and shows a <u>special purpose</u> split charged-coupled device (CCD) that is characterized by two regions **301** (**FIGs. 3 - 4**) and **302**, that are *controlled*

independently from one another. The two independently controlled regions **301** and **302** are separated by asymmetrical split **303**, with region **302** positioned between asymmetrical split **303** and horizontal registers **304**. See col. 4, lines 49 – 59. In operation, a plurality of spectra is placed in independently controlled region **301** as spectra **401**, **402**, **403** and **404** (**FIG. 4**,). Each spectra **401**, **402**, **403** and **404** is separated in independently controlled region **301** by a band of dark charge (one of dark charge bands **405a**, **405b**, **405c** and **405d**) that prevents interference between the spectral bands. See col. 4, lines 31 – 59 and col. 4, line 60 to col. 5, line 63. According to West, <u>charge from bands **405a**, **405b**, **405c** and **405d** is combined in only one binning operation, and that binning occurs in pixel row **406** of independently controlled region **302**</u> and not in horizontal registers **304**. Pixel row **406** is adjacent to asymmetrical split **303** and occupies the first pixel row in independently controlled region **302**. West expressly teaches that the charges from multiple rows in independently controlled region **301** are line binned in pixel row **406** of independently controlled region **302** and not in horizontal registers **304**. After each binning, the charges in rows of region **302** are shifted by exactly one row toward horizontal registers **304**. Therefore, at best, only one row of charge is entered in horizontal registers **304** at each shift (from charge that was previously combined in pixel row **406**). The single row of charge in horizontal registers **304** is then shifted off of the image sensor. See col. 4, line 40 to col. 5, line 3. Therefore, West does not teach or suggest combining any charge whatsoever in a shift register (*e.g.*, horizontal registers **304** or **305**) as expressly recited and required by claims **1, 25** and **28**, but instead teaches to enter charge from a single row into the horizontal register. The only combining of charges taught by West, occurs in a pixel row located in another independently controlled region of the array and not in the horizontal registers.

On paragraph 6 of the Advisory Action mailed February 2, 2007, the Examiner asserts that the portion of the claim language referring to combining charges from a first (or second) dependently controlled region of the N linear pixel arrays of the imaging sensor is "written broadly enough such that it specifies <u>how the charges are combined</u>

<u>with use of the N registers</u> and not necessarily that the charges must be combined **only** as they are entered [sic] the N registers ..."

The Appellant strenuously disagrees with this rejection and urges the Board to immediately overturn this rejection. The present claims **1, 25** and **28** recite "combining charge from a first dependently controlled region of the N linear pixel arrays of the imaging sensor <u>in the N registers</u>..." and also "combining charge from a second dependently controlled region of the N linear pixel arrays <u>in the N registers</u>" ... "said first and second dependently controlled regions having <u>at least three pixel lines</u> ..." Initially, the plain meaning of the claim term "combining charge" expressly requires that charges be *combined* in the N registers and not merely entered. Furthermore, a rudimentary grammatical analysis of the "combining" steps indicates that the prepositional phrase "in the N registers" describes where the charges will be combined. Therefore, the claims require at least some charge from one or both regions to be combined in the N registers. West does not teach or suggest combining any charge whatsoever in horizontal registers **304**. Instead, West teaches (and the Examiner agrees) only "entering" the charge from exactly one pixel row in horizontal registers **304** by shifting one row of charge from independently controlled region **302** into horizontal registers **304** subsequent to each line binning in pixel row **406**.

Additionally, if the term "combining" is to be read as merely "entering" as the Examiner asserts, only charge from a single pixel row could be transferred into the shift registers (else, entering the charge from more than one row would require that multiple rows of charge be *combined* in the registers and not merely entered). Contrary to the Examiner's assertions, the present claim language DOES NOT allow for each of the first and second dependently controlled regions to have only a single row, that is, the charge combined in the N registers originates in a region comprising <u>two or more pixel rows</u>. Hence, the charge is from two or more pixel rows and therefore it must be combined in the N shift registers and not merely transferred into them. For instance, present claims **1, 25** and **28** recite the charge integrated in the first region occupies at least one pixel

row ("... said first dependently controlled region of the N linear pixel arrays having at least one pixel line ...") and the charge integrated in the first and second regions occupy at least three pixel rows ("...said first and second dependently controlled regions having at least three pixel lines ..."). Therefore, at a minimum, the charge integrated in the first dependently controlled region occupies at least one pixel row and the charge integrated in the second dependently controlled region occupies at least two pixel rows. Thus, at least the charge from two pixel rows, from either the first dependently controlled region or the second dependently controlled region, must be combined in the N registers. West does not teach or suggest combining any charge whatsoever in horizontal registers **304**, but instead expressly teaches entering charge from only a single pixel row in the registers.

Finally, West does not teach or suggest any combining of charges in horizontal registers **304** because combining charges from region **302** in the registers would contaminate spectra charge with dark charge (or other spectral charge) and render West's asymmetrical split CCD device inoperable. West teaches binning spectra bands **401, 402, 403** and **404**, each band placed on at least four pixel rows in region **301**, in the first row across asymmetrical split **303** in region **302**, *i.e.*, row **406** (notice from **FIG. 4** that region **302** is located between horizontal registers **304** and asymmetrical split **303**). West further teaches combining each band of dark charge (**405a, 405b, 405c** and **405d**), which interleaved between respective spectra bands **401, 402, 403** and **404**, in the first row across asymmetrical split **303** in region **302**, *i.e.*, also in row **406**. Thus, after binning, region **302** contains alternating rows of combined spectra charge and combined dark charge. Therefore, if the rows within region **302** were to be combined (rather than merely entered), spectra and dark charge would mix in horizontal registers **304**. Hence, combining any charge in horizontal registers **304** would yield the special purpose split charged-coupled device inoperable since the spectra charge would be contaminated with the dark charge that West seeks to isolate from the spectra charge.

Therefore, the claims require that charges from a region with more than a single pixel line be combined in the N registers.

Because no reference teaches or suggests "combining charge from a first dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge from the first dependently controlled region along each of the N linear pixel arrays to each of the N registers..." in combination with "combining charge from a second dependently controlled region of the N linear pixel arrays in the N registers by shifting charge from the second dependently controlled region along each of the N linear pixel arrays to each of the N registers, <u>said first and second dependently controlled regions having at least three pixel lines</u> ...," the Examiner has not met the burden and it is respectfully urged that the Examiner's rejection of claims **1 - 4, 14 - 16** and **23 – 29** should not be sustained.

II. With further regard to claims **1 - 4, 14 - 16** and **23 - 29**, nowhere does the prior art cited by the Examiner describe the combination of "combining charge from a first <u>dependently controlled region</u> of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge from the <u>first dependently controlled region along each of the N linear pixel arrays to each of the N registers</u>, said first <u>dependently controlled region</u> of the N linear pixel arrays having at least one pixel line..." and "combining charge from a <u>second dependently controlled region of the N linear pixel arrays in the N registers by shifting charge from the second dependently controlled region along each of the N linear pixel arrays to each of the N registers</u>, said first and second dependently controlled regions having at least three pixel lines ..."

Nowhere does West teach or suggest combining charges from any <u>dependently controlled region</u> in a shift register (*e.g.*, horizontal registers **304** or **305**) as expressly recited and required by claims **1**, **25** and **28**, but instead and at best, West teaches to merely enter the charges from a <u>dependently controlled region</u> into a horizontal register and/or combine charges from a <u>dependently controlled region</u> into another independently controlled region of the imaging array and not into the N shift registers as

required. West discloses a asymmetrical split CCD device for efficiently shifting charges from multiple spectra without contaminating the separate spectra. As mentioned above, West's asymmetrical split CCD **300** comprises first independently controlled region **301** and second independently controlled region **302** with asymmetrical split **303** which separates the regions. The first and second regions must be independently controlled because the charge in one region is shifted across the pixels in that region independently from shifting operations occurring in the second independently controlled region. West's device requires the regions being independently controlled in order to combine (or binned) the charge from multiple pixel rows in region **301** into a single row in region **302** (pixel row **406**). When the charge in region **301** is shifted, the charge in region **302** must remain stationary in order to assure that the charges from multiple pixel rows resulting from exposure to any of spectra bands **401, 402, 403** and **404** is combined into a single pixel row in region **302**. Once charge is combined in row **406** of region **302**, the charge from exactly one pixel row is entered into horizontal registers **304** by shifting independently controlled region **302** exactly one row toward horizontal registers **304**, while the charge in region **301** remains stationary. Therefore, rather than "combining charge from a first (or second) dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers," West expressly teaches <u>entering</u> charge from a <u>first independently controlled</u> region in horizontal registers **304**.

According to the Examiner, independently controlled region **301** is comprised of separate dependently controlled regions of spectra bands **401, 402, 403** and **404**, each band placed on up to eight pixel rows in independently controlled region **301**. Further, the Examiner insists that region **401** cannot be shifted without also shifting region **402**, hence at least regions **401** and **402** are dependently controlled regions, and since regions **401** and **402** may have up to eight rows each, they exceed the limitation of three or more pixel rows. See paragraphs 9 - 11 of the Advisory Action mailed February 2, 2007.

Assuming, *arguendo*, that regions **401** and **402** are dependently controlled as asserted by the Examiner, the charges from those regions are not combined "in the N registers by shifting charge from the first dependently controlled region along each of the N linear pixel arrays to each of the N registers," but instead are combined in row **406** of independently controlled region **302**. Hence, even if regions **401** and **402** are dependently controlled as asserted by the Examiner, no charge from either of those regions is combined in horizontal registers **304** as required by the claims.

Furthermore, in paragraph 3, on page 4 of the Final Office Action, the Examiner also asserts that "all of the rows in each respective section (**301** and **302**) of West are dependently controlled with respect to that section." According to the Examiner, in addition to the pixel rows in region **302** being dependently controlled, the pixel rows in section **302** are also dependently controlled and, apparently therefore, the charge from those rows could be combined in horizontal registers **304** "by shifting charge from the first dependently controlled region along each of the N linear pixel arrays to each of..." horizontal registers **304**.

Here again however, even if Appellant agrees that the pixel rows in section **302** are also dependently controlled as asserted by Examiner, according to West each shift transfers the charge by exactly one pixel row, thereby entering the charge from only one pixel row in horizontal registers 304. More particularly, charge is binned from multiple rows region **301** in only pixel row **406** of region **302**. After each binning, the charge in region **302** is shifted by exactly one row and only one row of charge, that was previously combined in pixel row **406**, is entered in horizontal registers **304**. Thus, even if all of the rows in section **302** are dependently controlled with respect to that section as asserted by the Examiner, nowhere does West teach or suggest to combine "charge from a first dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers ," as recited in claim **1**, **25** and **28**. Furthermore, since the rows of section **302** contain alternating rows of spectral charge and dark charge, the charge from the rows in

region **302** could not be combined in horizontal registers **304** without obliterating the spectral charge, thereby rendering West's asymmetrical split CCD device inoperable.

Therefore, the claims require that charges from more than one dependently controlled region be combined in the N registers.

Because no reference teaches or suggests "combining charge from a first dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge from the first dependently controlled region along each of the N linear pixel arrays to each of the N registers, said first dependently controlled region of the N linear pixel arrays having at least one pixel line..." and "combining charge from a second dependently controlled region of the N linear pixel arrays in the N registers by shifting charge from the second dependently controlled region along each of the N linear pixel arrays to each of the N registers, said first and second dependently controlled regions having at least three pixel lines ...", the Examiner has not met the burden and it is respectfully urged that the Examiner's rejection of claims **1 - 4**, **14 - 16** and **23 – 29** should not be sustained.

III. With respect to claims **1 - 4**, **14 - 16** and **23 - 29**, the Examiner has improperly stated new grounds for the rejection in the Advisory Action, and the basis of these new grounds of rejection is improper under 35 USC § 102.

On paragraph 9 - 10 of the Advisory Action mailed February 2, 2007, the Examiner asserts that the portion of the claim language referring to the dependently controlled regions of the N linear pixel arrays is "written broadly enough such that how exactly the first and second regions are dependently controlled is not specified," and/or "are dependently controlled with respect to."

Appellant respectfully asserts that this rejection is improper and simply does not form the proper foundation for a rejection under 35 USC § 102, but instead seems more appropriately as a foundation of a rejection under 35 USC § 112 first and/or second paragraphs. Furthermore, Appellant asserts that the present claim language would be

well understood to those of ordinary skill in the relevant technology, who understand the working of a prior art CCD and or a common shift register.

Additionally, in the Final Office Action mailed on June 28, 2006, the Examiner had no difficulty in understanding the meaning of the claim terms and scope of the offending claim language related to dependently controlled regions, and was able to craft a rejection under section 102(b) over that language. There, the Examiner asserted in paragraph 3 on page 4 that West teaches that "all of the rows in each respective section (**301** and **302**) of West are dependently controlled with respect to that section."

It is respectfully asserted that the present claim language would be easily understood by those of ordinary skill in the art and give adequate notice of potential infringement. Therefore, the rejection of claims **1, 25** and **28** is improper and should be withdrawn.

Because the basis for this rejection does not form the proper foundation for a rejection under 35 USC § 102(b), and the plain meaning of the claim is unambiguous, the Examiner has not met the burden and it is respectfully urged that the Examiner's rejection of claims **1 - 4**, **14 - 16** and **23 – 29** should not be sustained.

IV. With respect to claims **1 - 4, 14 - 16** and **23 - 29,** the prior art cited by the Examiner would be inoperable if used in the manner necessary to meet the present claim limitations.

"In determining that quantum of prior art disclosure which is necessary to declare an applicant's invention 'not novel' or 'anticipated' within section 102, the stated test is whether a reference contains an 'enabling disclosure'... ." *In re Hoeksema*, 399 F.2d 269, 158 USPQ 596 (CCPA 1968). The disclosure in an assertedly anticipating reference must provide an enabling disclosure of the desired subject matter; mere naming or description of the subject matter is insufficient, if it cannot be produced without undue experimentation. *Elan Pharm., Inc. v. Mayo Found. For Med. Educ. & Research*, 346 F.3d 1051, 1054, 68 USPQ2d 1373, 1376 (Fed. Cir. 2003) (At issue was

whether a prior art reference enabled one of ordinary skill in the art to produce Elan's claimed transgenic mouse without undue experimentation. Without a disclosure enabling one skilled in the art to produce a transgenic mouse without undue experimentation, the reference would not be applicable as prior art.). A reference contains an "enabling disclosure" if the public was in possession of the claimed invention before the date of invention. "Such possession is effected if one of ordinary skill in the art could have combined the publication's description of the invention with his [or her] own knowledge to make the claimed invention." *In re Donohue,* 766 F.2d 531, 226 USPQ 619 (Fed. Cir. 1985).

West discloses a special purpose imaging array and explicitly discloses combining charge from unique spectra, each placed on bands of pixel rows **401**, **402**, **403** and **404** of independently controlled region **301**, in another independently controlled region *i.e.*, independently controlled region **302**. The spectral bands are each separated by bands of dark charge (**405a**, **405b**, **405c** and **405d**) (**FIG. 4**) that prevents interference between the spectral bands. The spectral bands of pixels rows **401**, **402**, **403** and **404**, and dark charge band of pixel rows **405a**, **405b**, **405c** and **405d** contain a like number of rows, *e.g.* four or eight rows in each band. The charge is shifted out of independently controlled region **301** by line binning the charge from multiple rows in one band into a single pixel row in independently controlled region **302**, row **406**. After a band of pixel rows are line binned in row **406**, the charges in independently controlled region **302** is shifted by exactly one row to make room in row **406** for the next band of charge. <u>Consequently, the rows of section **302** contain alternating rows of spectral charge and dark charge</u>. Therefore, the charges from the rows in region **302** could not be combined in horizontal register **304** without contaminating the spectral charge with dark charge, thereby rendering West's asymmetrical split CCD device inoperable.

Because the assertedly anticipating reference does not provide an enabling disclosure of the desired subject matter reference, the Examiner has not met the burden

and it is respectfully urged that the Examiner's rejection of claims **1 - 4, 14 - 16** and **23 – 29** should not be sustained.

B. The rejection of claims **33 - 40** under U.S.C. § 102(b) is incorrect.

Claim 33 recites:

A method for reading data from an imaging sensor, said imaging sensor comprising N linear pixel arrays, each of the N linear arrays having M dependently controlled charge coupled pixels, each pixel charge coupled, and further being coupled to one of N registers, the method comprising:

defining a first dependently controlled region of the N linear pixel arrays of the imaging sensor, said first dependently controlled region having at least one pixel;

defining a second dependently controlled region of the N linear pixel arrays of the imaging sensor, said second dependently controlled region having at least one pixel line, and said first and second dependently controlled regions having at least three pixel lines, and said at least three pixel lines of said first and second dependently controlled regions being oriented in generally orthogonal direction to the N linear pixel arrays;

defining a dark dependently controlled region of the N linear pixel arrays of the imaging sensor, said dark dependently controlled region having a plurality of dependently controlled pixel lines, said plurality of dependently controlled pixel lines are oriented in generally orthogonal direction to the N linear pixel arrays and said plurality of dependently controlled pixel lines are not exposed to light;

receiving a first image on at least some pixels of the first dependently controlled region of the N linear pixel arrays;

receiving a second image on at least some pixels of the second dependently controlled region of the N linear pixel arrays;

integrating charge in the at least some pixels of the first dependently controlled region of the N linear pixel arrays and in the at least some pixels of the second dependently controlled region of the N linear pixel arrays;

shifting charge from the at least some pixels of the first and second dependently controlled regions of the N linear pixel arrays along a linear path into said dark dependently controlled region of the N linear pixel arrays of the imaging sensor; and

reading out charge from said dark dependently controlled region, said charge from said dark dependently controlled region having been shifted from each dependently controlled region defined on the N linear pixel arrays of the imaging sensor.

With regard to claims **33 - 40**, the present invention is directed to a method for reading two spectrums from a prior art CCD imaging array without obliterating charge from one spectrum with the charge from the other spectrum.

I. With respect to claims **33 - 40**, nowhere does the prior art cited by the Examiner describe "shifting charge from the at least some pixels of the first <u>and</u> second dependently controlled regions of the N linear pixel arrays along a linear path <u>into</u> said dark dependently controlled region of the N linear pixel arrays of the imaging sensor ..." as recited in claim 33. (Appellant's emphasis)

The teaching of West in this regard appears to be uncontroverted. Briefly, West teaches that spectra are projected on bands **401**, **402**, **403** and **404**, wherein dark zones **405a**, **405b**, **405c** and **405d** are defined between the spectra bands. Also, spectral bands **401**, **402**, **403** and **404** are at least as wide as dark zones **405a**, **405b**, **405c** and **405d** defined therebetween. As the dark charge in dark zone **405a** is binned in row **406** above asymmetrical split **303**, at least a portion of the charge from spectral band **401** shifts into dark zone **405a**. However, because the bands of spectral charge **401**, **402**, **403** and **404** and dark charge in zones **405a**, **405b**, **405c** and **405d** occupy the same number of rows, it is impossible for a portion of one of spectra bands **401**, **402**, **403** and **404** to occupy a dark zone with a portion of another spectral band. At best, <u>a dark zone can hold only a single spectral band</u>. See col. 4, line 28, *et seq*.

The Examiner contends in paragraph 4 of the Office Action mailed on June 28, 2006, and again in paragraph 14 of the Advisory Action mailed February 2, 2007, that charge from only one region that merely passes through a dark region satisfies the claim limitations. In that advisory action the Examiner points to the Applicants previous arguments asserting that the claims require "that the charge from each of the two regions must be in the dark region at the same time," and asserts that "... such features are not claimed," and at best, the claim language is written broadly enough that first shifting charge <u>through</u> the dark region and then second shifting charge from another single region through the dark region is all that is required." (Appellant's emphasis). In

other words, the Examiner contends that the charges from the first and second regions are sifted into and out of the dark region sequentially.

Appellant strenuously disagrees with the Examiner's conclusions for the reasons given below.

Initially, the language of claim **33** places two limitations on the shifting step, firstly the charge is from "at least some pixels of the first <u>and</u> second dependently controlled regions" is shifted, and secondly the charge is shifted from the regions "along a linear path <u>into</u> said dark dependently controlled region of the N linear pixel arrays of the imaging sensor." The plain meaning of claim **33** is clear and unambiguous. Charge that was integrated in pixel rows of the first dependently controlled region <u>and</u> charge that was integrated in pixel rows of the second dependently controlled region must both be shifted <u>into</u> the dark region. The claim term "and" places a temporal requirement for handling the charges from the first and second regions, *i.e.*, the charges from both regions must be shifted together. Additionally, the preposition "into" places a spatial constraint on the charges simultaneously with the temporal constraint, hence, the charges from the first and second regions must be shifted <u>inside</u> the dark region and not merely through it. (the preposition "into" means "a preposition indicating that somebody or something is or moves <u>inside</u> something, either physically or figuratively," (Appellant's emphasis) *Encarta College Dictionary*, St. Martin's Press, ISBN 0-312-28087-4, (2001) p. 754). Therefore, charge from the both the first and second regions must shifted to the interior of or inside the dark region.

Additionally, the claims explicitly require that <u>all</u> of the charges resulting from exposure to both the first and second images be shifted into the dark region and not merely some part of the charge as would be the case if the charged were merely transferred through the dark region. The phrase "the at least some pixels of the first and second dependently controlled regions of the N linear pixel arrays" finds antecedent basis in "receiving a first image on at least some pixels of the first dependently controlled region of the N linear pixel arrays," and "receiving a second image on at least

some pixels of the second dependently controlled region of the N linear pixel arrays." Therefore, the claim limitation "at least some pixels of the first and second dependently controlled regions" refers to all of the charge integrated in pixels that the first and second images are projected on. Consequently, the charges from any and all of the pixel lines exposed to the first and second images are shifted into the dark region and not merely some charge from some pixel lines in a region without any relationship to the image. Thus, the present claims positively require that all of the charges resulting from exposure to the first and second images be shifted into the dark region.

Appellant's arguments to the meaning of the shifting step are further bolstered by the limitations on the charge in the "reading out" step. There, claim **33** recites "reading out charge from said dark dependently controlled region," however the step specifies that the charges in the dark region are not from only a single region, such as one of the first or second regions, but the charges are from each region, *i.e.*, "said charge from said dark dependently controlled region having been shifted from each dependently controlled region." Thus, charge in the dark region that is available for reading out must originate in both the first region and the second region, and not in only one of the first or second region as continental by the Examiner.

Support for shifting charge from the at least some pixels of the first and second dependently controlled regions of the N linear pixel arrays along a linear path into said dark dependently controlled region of the N linear pixel arrays of the imaging sensor ..." can be found in the specification beginning on page 23, line 7 and in the flowchart depicted in **FIG. 13** (shown the shifting of M rows, *i.e.*, M vertical shifts, into the dark region prior to separately reading out each region's charge).

Therefore the claims require that the charges from the first and second dependently controlled regions of the N linear pixel arrays be shifted along a linear path into a dark dependently controlled region.

Because no reference teaches or suggests "shifting charge from the at least some pixels of the first and second dependently controlled regions of the N linear pixel arrays along a linear path into said dark dependently controlled region of the N linear pixel arrays of the imaging sensor ..." the Examiner has not met the burden and it is respectfully urged that the Examiner's rejection of claims **33 – 40** should not be sustained.

C. The rejection of claims **41 - 50** under U.S.C. § 102(b) is incorrect.

Claim 41 recites:

A method for reading data from an imaging sensor, said imaging sensor comprising N linear pixel arrays, each of the N linear arrays having M dependently controlled charge coupled pixels, each pixel charge coupled, and further being coupled to one of N registers, the method comprising:

integrating charge in at least some pixels of a first dependently controlled region of the N linear pixel arrays and at least some pixels of a second dependently controlled region of the N linear pixel arrays, said first dependently controlled region of the N linear pixel arrays having at least one pixel line and said at least one pixel line of the first dependently controlled region is oriented in generally orthogonal direction to the N linear pixel arrays, said second region of the N linear pixel arrays having at least one pixel line and said first and second dependently controlled regions having at least three pixel lines, and each of said at least three pixel lines of said first and second dependently controlled regions being oriented in generally orthogonal direction to the N linear pixel arrays;

shifting charge from the at least some pixels of the first and second dependently controlled regions of the N linear pixel arrays along a linear path into a dark dependently controlled region of the N linear pixel arrays of the imaging sensor, said dark dependently controlled region of the N linear pixel arrays having at least two pixel lines, said at least two pixel lines of the dark dependently controlled region are oriented in generally orthogonal direction to the N linear pixel arrays and are not exposed to light;

combining charge integrated in the first dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge from the dark dependently controlled region along each of the N linear pixel arrays to each of the N registers;

shifting charge from the N registers along a linear path;

representing charge from at least a portion of the first dependently controlled region of the N linear pixel arrays, shifted out of the N registers, as a corresponding portion of N first region data signals;

combining charge integrated in the second dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge from the dark dependently controlled region along each of the N linear pixel arrays to each of the N registers;

shifting charge from the N registers along a linear path;

representing charge from at least a portion of the second dependently controlled region of the N linear pixel arrays, shifted out of the N registers, as a corresponding portion of N second region data signals; and

clearing charge from the dark dependently controlled region of the N linear pixel arrays of the imaging sensor.

I. With respect to claims **41 - 50**, nowhere does the prior art cited by the Examiner describe "shifting charge from the at least some pixels of the first <u>and</u> second dependently controlled regions of the N linear pixel arrays along a linear path <u>into</u> said dark dependently controlled region of the N linear pixel arrays of the imaging sensor ..." as recited in claim **41**.

Arguments in support of the allowability of these claim limitations are presented directed above in paragraph VII(B)I.

Because no reference teaches or suggests "shifting charge from the at least some pixels of the first and second dependently controlled regions of the N linear pixel arrays along a linear path into said dark dependently controlled region of the N linear pixel arrays of the imaging sensor ..." the Examiner has not met the burden and it is respectfully urged that the Examiner's rejection of claims **41 - 50** should not be sustained.

II. With respect to claims **41 - 50**, nowhere does the prior art cited by the Examiner describe "combining charge integrated in the first dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge from the dark dependently controlled region along each of the N linear pixel arrays to each of the N registers" and then "combining charge integrated in

the second dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge from the dark dependently controlled region along each of the N linear pixel arrays to each of the N registers“ as recited in claim **41**.

Attention is directed to paragraph VII(A)I above where arguments in support of the allowability of these claim limitations are presented.

Because no reference teaches or suggests “combining charge integrated in the first dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge from the dark dependently controlled region along each of the N linear pixel arrays to each of the N registers” and then “combining charge integrated in the second dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge from the dark dependently controlled region along each of the N linear pixel arrays to each of the N registers“ the Examiner has not met the burden and it is respectfully urged that the Examiner's rejection of claims **41 - 50** should not be sustained.

D. Conclusion

In view of the above comments, it is respectfully urged that the examiner's rejection of the claims should not be sustained.

Respectfully submitted,

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IX. CLAIMS INDEX (37 C.F.R. 41.37(c)(1)(viii)):

The text of the claims involved in the appeal are:

Claim 1 (previously presented): A method for enhancing dynamic range of data read from an imaging sensor, said imaging sensor comprising N linear pixel arrays, each of the N linear arrays having M dependently controlled charge coupled pixels, each pixel charge coupled, and further being coupled to one of N registers, the method comprising:

integrating charge in at least some pixels of the N linear pixel arrays;

combining charge from a first dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge from the first dependently controlled region along each of the N linear pixel arrays to each of the N registers, said first dependently controlled region of the N linear pixel arrays having at least one pixel line and said at least one pixel line of the first dependently controlled region is oriented in generally orthogonal direction to the N linear pixel arrays;

shifting charge from the N registers along a linear path;

representing charge from at least a portion of the first dependently controlled region of the N linear pixel arrays, shifted out of the N registers, as a corresponding portion of N first region data signals;

combining charge from a second dependently controlled region of the N linear pixel arrays in the N registers by shifting charge from the second dependently controlled region along each of the N linear pixel arrays to each of the N registers, said first and second dependently controlled regions having at least three pixel lines, and said at least three pixel lines being oriented in generally orthogonal direction to the N linear pixel arrays;

shifting charge from the N registers along a linear path; and

representing charge from at least a portion of the second dependently controlled region of the N linear pixel arrays, shifted out of the N registers, as a corresponding portion of N second region data signals.

Claim 2 (original): The method for increasing dynamic range recited in claim 1 above further comprises:

presenting said portion of N first region data signals; and

presenting said portion of N second region data signals.

Claim 3 (original): The method for increasing dynamic range recited in claim 2 above, wherein said first portion comprises N first region data signals and said second portion comprises N second region data signals.

Claim 4 (previously presented): The method for increasing dynamic range recited in claim 1 above further comprises:

defining the first dependently controlled region of the N linear pixel arrays of the imaging sensor by designating at least one pixel line as belonging to the first dependently controlled region of the N linear pixel arrays.

Claim 5 (previously presented): The method for increasing dynamic range recited in claim 4 above, wherein defining the first dependently controlled region of the N linear pixel arrays of the imaging sensor by designating at least one pixel line as belonging to the first dependently controlled region of the N linear pixel arrays further comprises:

assessing a level of improvement in dynamic range in at least one signal taken from the portion of N first region data signals, and the portion of N second region data signals; and

determining an amount of pixel lines belonging to the first dependently controlled region of the N linear pixel arrays for improving the dynamic range in the at least one signal, wherein said amount of pixel lines relates to the level of improvement in dynamic range.

Claim 6 (previously presented): The method for increasing dynamic range recited in claim 4 above, wherein defining the first dependently controlled region of the N linear pixel arrays of the imaging sensor by designating at least one pixel line as belonging to the first dependently controlled region of the N linear pixel arrays further comprises:

setting at least one target signal level;

selecting at least one signal from one of the portion of N first region data signals and the portion of N second region data signals; and

comparing the selected at least one signal to the at least one target signal level;

adjusting an amount of pixel lines belonging to the first dependently controlled region of the N linear pixel arrays, wherein said adjustment is based on the comparison of the selected at least one signal to the at least one target signal level.

Claim 7 (previously presented): The method for increasing dynamic range recited in claim 6 above, wherein adjusting an amount of pixel lines belonging to the first dependently controlled region of the N linear pixel arrays further comprises altering the amount of pixel lines belonging to the first dependently controlled region by a predetermined proportion of the amount of pixel lines.

Claim 8 (previously presented): The method for increasing dynamic range recited in claim 6 above, wherein adjusting an amount of pixel lines belonging to the first dependently controlled region of the N linear pixel arrays further comprises altering the amount of pixel lines belonging to the first dependently controlled region by a predetermined number of pixel lines.

Claim 9 (previously presented): The method for increasing dynamic range recited in claim 6 above further comprises modifying an amount of pixel lines belonging to the second dependently controlled region based on the sum of pixel lines in the first

dependently controlled region and second dependently controlled region being equivalent to an amount of pixels in any one of the N linear arrays.

Claim 10 (original): The method for increasing dynamic range recited in claim 9 above, wherein said amount of pixels in each of the N linear arrays is M pixels.

Claim 11 (previously presented): The method for increasing dynamic range recited in claim 9 above further comprises:

integrating charge in at least some pixels of the N linear pixel arrays;

combining charge from the first dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge from said adjusted amount of pixel lines of the first dependently controlled region along each of the N linear pixel arrays to each of the N registers;

shifting charge from the N registers along a linear path;

representing charge from at least a portion of the first dependently controlled region of the N linear pixel arrays, shifted out of the N registers, as a corresponding portion of N first region data signals;

combining charge from the second dependently controlled region of the N linear pixel arrays in the N registers by shifting charge from said modified amount of pixel second dependently controlled region along each of the N linear pixel arrays to each of the N registers; and

shifting charge from the N registers along a linear path; and

representing charge from at least a portion of the second dependently controlled region of the N linear pixel arrays, shifted out of the N registers, as a corresponding portion of N second region data signals.

Claim 12 (original): The method for increasing dynamic range recited in claim 6 above, wherein said adjustment based on the comparison of the selected at least one signal to the at least one target signal level relates to difference betweens the selected at least one signal to the at least one target signal level.

Claim 13 (original): The method for increasing dynamic range recited in claim 6 above, wherein the at least one target signal is a range of target signal levels, and said adjustment based on the comparison of the selected at least one signal to the at least one target signal level relates to a difference between the selected at least one signal to the range of target signal levels.

Claim 14 (previously presented): The method for increasing dynamic range recited in claim 4 above, wherein defining the first dependently controlled region of the N linear pixel arrays of the imaging sensor is accomplished during a setup phase of a device incorporating said imaging sensor.

Claim 15 (previously presented): The method for increasing dynamic range recited in claim 4 above, wherein defining the first dependently controlled region of the N linear pixel arrays of the imaging sensor is accomplished dynamically, following said integrating charge in at least some pixels of the N linear pixel arrays, and prior to a subsequent integration of charge in at least some pixels of the N linear pixel arrays.

Claim 16 (original): The method for increasing dynamic range recited in claim 1 above further comprises:

presenting said portion of N first region data signals as a first channel of small-amplitude signals; and

presenting said portion of N second region data signals as a second channel of large-amplitude signals.

Claim 17 (previously presented): The method for increasing dynamic range recited in claim 16 above further comprises:

re-scaling one of said small-amplitude signals from said first dependently controlled region and said large-amplitude signals from said second dependently controlled region.

Claim 18 (previously presented): The method for increasing dynamic range recited in claim 17 above, wherein re-scaling one of said small-amplitude signals from said first dependently controlled region and said large-amplitude signals from said second dependently controlled region is based on a scale of the other of said small-amplitude signals from said first dependently controlled region and said large-amplitude signals from said second dependently controlled region.

Claim 19 (previously presented): The method for increasing dynamic range recited in claim 16 above further comprises:

determining a relationship between said small-amplitude signals of said first channel from said first dependently controlled region, and said large-amplitude signals of said second channel from said second dependently controlled region.

Claim 20 (previously presented): The method for increasing dynamic range recited in claim 19 above further comprises:

applying said relationship to the corresponding at least one data signal from the N data signals representing charge from the first dependently controlled region of the N linear pixel arrays; and

replacing said at least one of the N data signals representing a saturated condition from the second dependently controlled region of the N linear pixel arrays.

Claim 21 (original): The method for increasing dynamic range recited in claim 20 above, wherein each of said N linear pixel arrays corresponds to a wavelength channel of an N wavelength channel spectrum and each of said N data signals representing an amplitude of said N wavelength channels of the spectrum.

Claim 22 (previously presented): The method for increasing dynamic range recited in claim 21 above further comprises:

presenting as a wide dynamic-range spectrum, the data signals from the second dependently controlled channel of large-amplitude signals representing charge from said second dependently controlled region, and, the corresponding at least one data signal from the N data signals representing charge from the first dependently controlled region of the N linear pixel arrays replacing said at least one of the N data signals representing a saturated condition from the second dependently controlled region of the N linear pixel arrays.

Claim 23 (original): The method for increasing dynamic range recited in claim 1 above, wherein a corresponding each of said portion of N first region data signals and each of said portion of N second region data signals both correspond to at least one discrete wavelength.

Claim 24 (original): The method for increasing dynamic range recited in claim 1 above further comprises:

combining a part of said portion of N first region data signals with a non-corresponding part of said portion of N second region data signals; and

presenting the part of said portion of N first region data signals and the non-corresponding part of said portion of N second region data signals as a plurality of data signals.

Claim 25 (previously presented): An imaging apparatus having enhancing dynamic range comprising:

an imaging sensor comprising:

N linear arrays, each of the N linear arrays having M dependently controlled charge coupled pixels;

M pixel lines, said M pixel lines being oriented in generally orthogonal direction to the N linear pixel arrays;

N registers, wherein one pixel in each of the N linear pixel arrays being charge coupled to a respective one of the N registers;

signal converter connected to at least one of said N registers for representing a charge as a data signal; and

an output node coupled to said signal converter;

a memory connected to said output node;

a readout controller coupled to said imaging sensor for controlling readout of said M dependently controlled charge coupled pixels in all the N linear pixel arrays; and

means for instructing said readout controller for combining charge from a first dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge from the first dependently controlled region along each of the N linear pixel arrays to each of the N registers, said first dependently controlled region of the N linear pixel arrays having at least one pixel line, and for shifting charge from the N registers along a linear path to said signal converter, and for transferring said N first dependently controlled region data signals to said memory, and further for instructing said readout controller for combining charge from a second dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge along each of the N linear pixel arrays to each of the N registers, said first and second dependently controlled regions having at least three pixel lines, and for

shifting charge from the N registers along a linear path to said signal converter, and for transferring said N second region data signals to said memory.

Claim 26 (original): The imaging apparatus recited in claim 25 above, wherein said memory being coupled to a display device.

Claim 27 (previously presented): The imaging apparatus recited in claim 25 above, wherein said means for instructing alters an amount of pixel lines in a dependently controlled region prior to instructing said readout controller.

Claim 28 (previously presented): A computer program product, comprising a computer-readable medium having stored thereon computer executable instructions for implementing a method for enhancing dynamic range of data read from an imaging sensor having a controller that executes a plurality of reordered commands, said computer executable instructions comprising:

instructions for integrating charge in at least some pixels of N linear pixel arrays;

instructions for combining charge from a first dependently controlled region of N linear pixel arrays of the imaging sensor in N registers by shifting charge from the first dependently controlled region along each of the N linear pixel arrays to each of the N registers, said first dependently controlled region of the N linear pixel arrays having at least one pixel line and said at least one pixel line of the first dependently controlled region is oriented in generally orthogonal direction to the N linear pixel arrays;

instructions for shifting charge from the N registers along a linear path;

instructions for representing charge from at least a portion of the first dependently controlled region of the N linear pixel arrays, shifted out of the N registers, as a corresponding portion of N first region data signals;

instructions for combining charge from a second dependently controlled region of the N linear pixel arrays in the N registers by shifting charge from the second dependently controlled region along each of the N linear pixel arrays to each of the N registers, said first and second dependently controlled regions having at least three pixel lines, and said at least three pixel lines being oriented in generally orthogonal direction to the N linear pixel arrays; and

instructions for shifting charge from the N registers along a linear path; and

instructions for representing charge from at least a portion of the second dependently controlled region of the N linear pixel arrays, shifted out of the N registers, as a corresponding portion of N second region data signals.

Claim 29 (previously presented): The computer program product recited in claim 28 above further comprises:

instructions for defining the first dependently controlled region of the N linear pixel arrays of the imaging sensor by designating at least one pixel line as belonging to the first dependently controlled region of the N linear pixel arrays.

Claim 30 (previously presented): The computer program product recited in claim 29 above further comprises:

instructions for assessing a level of improvement in dynamic range in at least one signal taken from the portion of N first region data signals, and the portion of N second region data signals; and

instructions for determining an amount of pixel lines belonging to the first dependently controlled region of the N linear pixel arrays for improving the dynamic range in the at least one signal, wherein said amount of pixel lines relates to the level of improvement in dynamic range.

Claim 31 (previously presented): The computer program product recited in claim 29 above further comprises:

instructions for setting at least one target signal level;

instructions for selecting at least one signal from one of the portion of N first region data signals and the portion of N second region data signals;

instructions for comparing the selected at least one signal to the at least one target signal level; and

instructions for adjusting an amount of pixel lines belonging to the first dependently controlled region of the N linear pixel arrays, wherein said adjustment is based on the comparison of the selected at least one signal to the at least one target signal level.

Claim 32 (previously presented): The computer program product recited in claim 31 above further comprises:

instructions for altering the amount of pixel lines belonging to the first dependently controlled region by a predetermined proportion of the amount of pixel lines.

Claim 33 (previously presented): A method for reading data from an imaging sensor, said imaging sensor comprising N linear pixel arrays, each of the N linear arrays having M dependently controlled charge coupled pixels, each pixel charge coupled, and further being coupled to one of N registers, the method comprising:

defining a first dependently controlled region of the N linear pixel arrays of the imaging sensor, said first dependently controlled region having at least one pixel;

defining a second dependently controlled region of the N linear pixel arrays of the imaging sensor, said second dependently controlled region having at least one pixel line, and said first and second dependently controlled regions having at least three pixel lines, and said at least three pixel lines of said first and second dependently controlled regions being oriented in generally orthogonal direction to the N linear pixel arrays;

defining a dark dependently controlled region of the N linear pixel arrays of the imaging sensor, said dark dependently controlled region having a plurality of dependently controlled pixel lines, said plurality of dependently controlled pixel lines are oriented in generally orthogonal direction to the N linear pixel arrays and said plurality of dependently controlled pixel lines are not exposed to light;

receiving a first image on at least some pixels of the first dependently controlled region of the N linear pixel arrays;

receiving a second image on at least some pixels of the second dependently controlled region of the N linear pixel arrays;

integrating charge in the at least some pixels of the first dependently controlled region of the N linear pixel arrays and in the at least some pixels of the second dependently controlled region of the N linear pixel arrays;

shifting charge from the at least some pixels of the first and second dependently controlled regions of the N linear pixel arrays along a linear path into said dark dependently controlled region of the N linear pixel arrays of the imaging sensor; and

reading out charge from said dark dependently controlled region, said charge from said dark dependently controlled region having been shifted from each dependently controlled region defined on the N linear pixel arrays of the imaging sensor.

Claim 34 (previously presented): The method for reading data recited in claim 33 above, wherein, for each dependently controlled region, reading out charge from said dark dependently controlled region further comprises:

combining charge integrated in a region of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge from the dark dependently controlled region along each of the N linear pixel arrays to each of the N registers;

shifting charge from the N registers along a linear path; and

representing charge from at least a portion of the dependently controlled region of the N linear pixel arrays, shifted out of the N registers, as a corresponding portion of N data signals associated with the dependently controlled region.

Claim 35 (previously presented): The method for reading data recited in claim 34 above further comprises:

shifting charge from the dark dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers; and

discarding the charge shifted from the dark dependently controlled region of the N linear pixel arrays of the imaging sensor.

Claim 36 (previously presented): The method for reading data recited in claim 34 above, wherein the first dependently controlled region is further defined as a third dependently controlled region and a fourth dependently controlled region of the N linear pixel arrays of the imaging sensor.

Claim 37 (original): The method for reading data recited in claim 36 above further comprises:

presenting said corresponding portion of N first region data signals; and

presenting said corresponding portion of N second region data signals.

Claim 38 (original): The method for reading data recited in claim 37 above, wherein presenting said portion of N first region data signals further comprises:

presenting said corresponding portion of N third region data signals; and

presenting said corresponding portion of N fourth region data signals.

Claim 39 (previously presented): The method for reading data recited in claim 33, wherein a sum of the pixel lines defined in said first dependently controlled region, said second dependently controlled region and said dark dependently controlled region comprises at least M pixel lines.

Claim 40 (previously presented): The method for reading data recited in claim 39, wherein said plurality of pixel lines of the dark dependently controlled region of the N linear pixel arrays is defined as at least M/2 pixel lines.

Claim 41 (previously presented): A method for reading data from an imaging sensor, said imaging sensor comprising N linear pixel arrays, each of the N linear arrays having M dependently controlled charge coupled pixels, each pixel charge coupled, and further being coupled to one of N registers, the method comprising:

integrating charge in at least some pixels of a first dependently controlled region of the N linear pixel arrays and at least some pixels of a second dependently controlled region of the N linear pixel arrays, said first dependently controlled region of the N linear pixel arrays having at least one pixel line and said at least one pixel line of the first dependently controlled region is oriented in generally orthogonal direction to the N linear pixel arrays, said second region of the N linear pixel arrays having at least one pixel line and said first and second dependently controlled regions having at least three pixel lines, and each of said at least three pixel lines of said first and second dependently controlled regions being oriented in generally orthogonal direction to the N linear pixel arrays;

shifting charge from the at least some pixels of the first and second dependently controlled regions of the N linear pixel arrays along a linear path into a dark dependently controlled region of the N linear pixel arrays of the imaging sensor, said dark dependently controlled region of the N linear pixel arrays having at least two pixel lines, said at least two pixel lines of the dark dependently controlled region are oriented in generally orthogonal direction to the N linear pixel arrays and are not exposed to light;

combining charge integrated in the first dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge from the dark dependently controlled region along each of the N linear pixel arrays to each of the N registers;

shifting charge from the N registers along a linear path;

representing charge from at least a portion of the first dependently controlled region of the N linear pixel arrays, shifted out of the N registers, as a corresponding portion of N first region data signals;

combining charge integrated in the second dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers by shifting charge from the dark dependently controlled region along each of the N linear pixel arrays to each of the N registers;

shifting charge from the N registers along a linear path;

representing charge from at least a portion of the second dependently controlled region of the N linear pixel arrays, shifted out of the N registers, as a corresponding portion of N second region data signals; and

clearing charge from the dark dependently controlled region of the N linear pixel arrays of the imaging sensor.

Claim 42 (original): The method for reading data recited in claim 41 above further comprises:

presenting said portion of N first region data signals; and

presenting said portion of N second region data signals.

Claim 43 (original): The method for reading data recited in claim 42 above, wherein said first portion comprises N first region data signals and said second portion comprises N second region data signals.

Claim 44 (previously presented): The method for increasing dynamic range recited in claim 41 above, wherein integrating charge in at least some pixels of a first dependently controlled region of the N linear pixel arrays and at least some pixels of a second dependently controlled region of the N linear pixel arrays, further comprises:

accumulating charge in the at least some pixels of the first and second dependently controlled regions of the N linear pixel arrays for a predetermined time period.

Claim 45 (previously presented): The method for reading data recited in claim 41 above, wherein clearing charge from the dark dependently controlled region of the N linear pixel arrays further comprises:

shifting charge from the dark dependently controlled region of the N linear pixel arrays of the imaging sensor in the N registers; and

discarding the charge shifted from the dark dependently controlled region of the N linear pixel arrays of the imaging sensor.

Claim 46 (previously presented): The method for reading data recited in claim 41, wherein the dark dependently controlled region of the N linear pixel arrays comprises a quantity of pixel lines at least as great as a sum of said at least one pixel line of the first dependently controlled region and said at least one pixel line of the second dependently controlled region.

Claim 47 (previously presented): The method for reading data recited in claim 41, wherein the dark dependently controlled region of the N linear pixel arrays comprises at least M/2 pixel lines.

Claim 48 (previously presented): The method for reading data recited in claim 41, wherein said first dependently controlled region of the N linear pixel arrays having a first image projected thereon, and said second dependently controlled region of the N linear pixel arrays having a second image projected thereon.

Claim 49 (previously presented): The method for reading data recited in claim 41, wherein said first dependently controlled region of the N linear pixel arrays being exposed to a first light source, and said second dependently controlled region of the N linear pixel arrays being exposed to a second light source.

Claim 50 (previously presented): The method for reading data recited in claim 41 above further comprises:

integrating charge in at least some pixels of at least one other dependently controlled region of the N linear pixel arrays, each of said at least one other dependently controlled region of the N linear pixel arrays having at least one pixel line and said at least one pixel line of said at least one other dependently controlled region of the N linear pixel arrays is oriented in generally orthogonal direction to the N linear pixel arrays;

shifting charge from the at least some pixels of said at least one other dependently controlled region of the N linear pixel arrays along a linear path into a dark dependently controlled region of the N linear pixel arrays of the imaging sensor;

for each of the at least one other dependently controlled region of the N linear pixel arrays, combining charge integrated in one of the at least one other dependently controlled region of the N linear pixel arrays by shifting charge from the dark dependently controlled region along each of the N linear pixel arrays to each of the N registers; and

shifting charge from the N registers along a linear path.

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Documents transmitted:

1. Transmittal (1 Page);
2. Appeal Brief (~~52~~ 54 pages)
3. PTO Form 2038 (1 Page); and
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